APPENDIX E

ENVIRONMENTAL NOISE ANALYSIS

ENVIRONMENTAL NOISE ASSESSMENT KAISER HOSPITAL HELIPAD OPERATIONS SANTA CLARA, CALIFORNIA

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INTRODUCTION

The following report presents the environmental noise assessment conducted for the proposed helipad at the new Kaiser Santa Clara Hospital facility, located southwest of the intersection of Homestead Road and Lawrence Expressway in the City of Santa Clara (see Figure 1, below). The helipad will be located on a raised platform just south of the Phase II portion of the Hospital building. This location places the center of the pad approximately 310 feet from the residential area to the south of the Hospital site and approximately 65 feet from the Hospital's southern facade. The Setting Section of this report presents a discussion of the fundamentals of environmental acoustics, regulatory background information, and a discussion of the existing noise environment on and around the site. The Helipad Operational Noise section first discusses the character of helicopter noise and then presents and compares the operational noise levels modeled for helipad operations at both the new Homestead Road/Lawrence Expressway facility and at the existing Kiely Boulevard facility. The impacts and mitigation measures section of this report evaluates impacts associated with helicopter flights at the new hospital site, and presents mitigation measures for identified significant impacts.

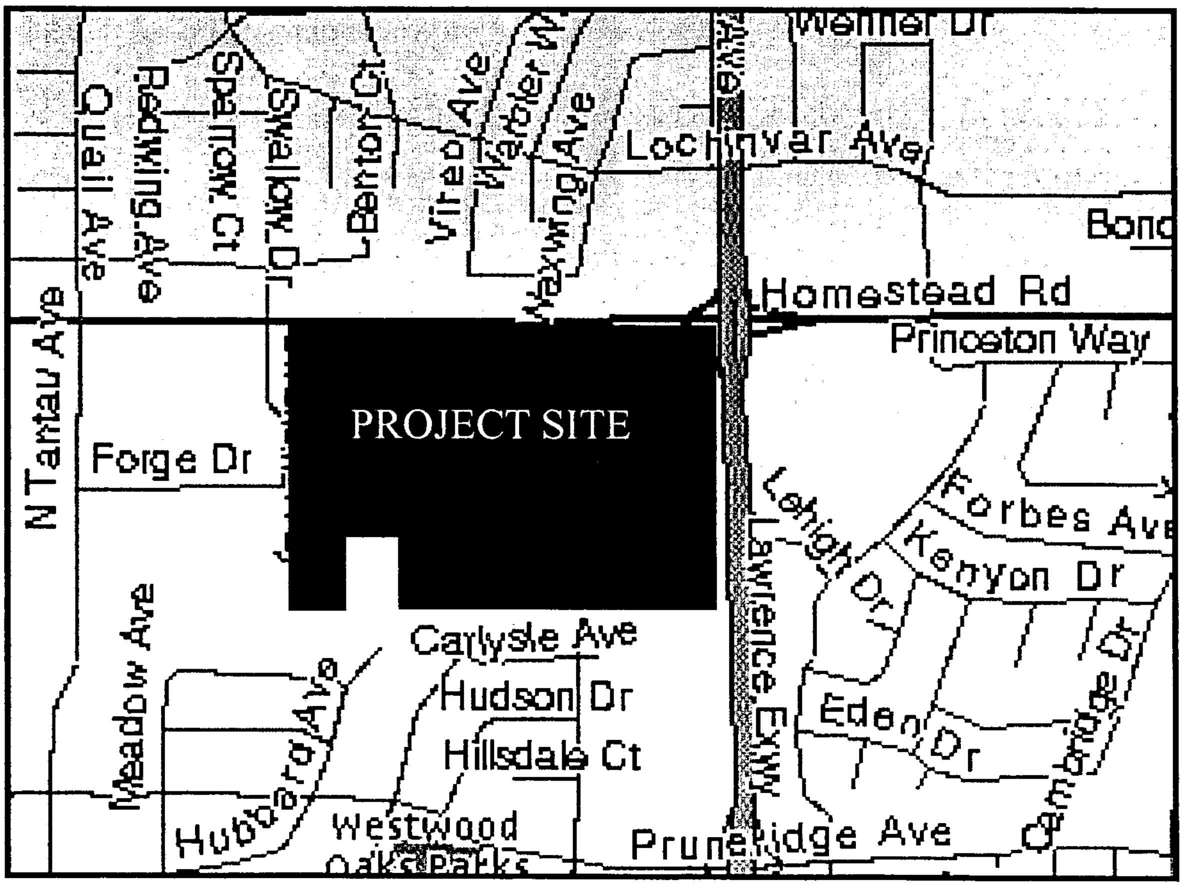

FIGURE 1: SITE VICINITY

SETTING

FUNDAMENTAL CONCEPTS OF ENVIRONMENTAL ACOUSTICS

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound may be caused by either its *pitch* or its loudness. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales that are used to describe noise in a particular location. *A decibel (dB)* is a unit of measurement that indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10-decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration. There are several methods of characterizing sound. The most common in California is the *A-weighted sound level or dBA.* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative indoor and outdoor noise levels in units of dBA are shown in Table 2.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

TABLE 1 DEFINITIONS OF ACOUSTICAL TERMS USED IN THIS REPORT

Term	Definitions
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, Leq	The average A-weighted noise level during the measurement period. The hourly Leq used for this report is denoted as dBA $L_{eq[h]}$.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels in the night between 10:00 pm and 7:00 am.
Day/Night Noise Level, L_{dn}	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

TABLE 2 TYPICAL NOISE LEVELS IN THE ENVIRONMENT

Common Outdoor Noise Source	Noise Level (dBA)	Common Indoor Noise Source
	120 dBA	
Jet fly-over at 300 meters		Rock concert
	110 dBA	
Pile driver at 20 meters	100 dBA	
		Night club with live music
	90 dBA	
Large truck pass by at 15 meters		
	80 dBA	Noisy restaurant
		Garbage disposal at 1 meter
Gas lawn mower at 30 meters	70 dBA	Vacuum cleaner at 3 meters
Commercial/Urban area daytime		Normal speech at 1 meter
Suburban expressway at 90 meters	60 dBA	
Suburban daytime		Active office environment
	50 dBA	
Urban area nighttime		Quiet office environment
	40 dBA	
Suburban nighttime		
Quiet rural areas	30 dBA	Library
		Quiet bedroom at night
Wilderness area	20 dBA	
Most quiet remote areas	10 dBA	Quiet recording studio
Threshold of human hearing	0 dBA	Threshold of human hearing

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level, CNEL*, is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level, L_{dn},* is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noise of sufficient intensity; above 35 dBA, and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open windows and 65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, those facing major roadways and freeways typically need sound rated glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 55 dBA L_{dn}. At an L_{dn} of about 60 dBA, approximately 2% of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 12% of the population. There is, therefore, an increase of about 1 percent per dBA between an L_{dn} of 60-70 dBA. Between an L_{dn} of 70-80 dBA, each decibel increase increases by about 2% the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the L_{dn} is 60 dBA, approximately 10% of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 2 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 3% increase in the percentage of the population highly annoyed.

REGULATORY BACKGROUND

The State of California and the City of Santa Clara have established regulations, plans, and policies that are designed to limit noise exposure at noise sensitive land uses. These include; (1) the State CEQA Guideline, Appendix G; (2) the State Building Code; and (3) the City of Santa Clara General Plan Noise Element and City Code. The State Aeronautics Act and California Airport Noise Regulations also regulate noise exposure from special-use helipads at hospitals.

State CEQA Guidelines

The California Environmental Quality Act (CEQA) has established guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. CEQA asks the following questions:

Would the project result in:

- → Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies?
- → Exposure of persons to or generation of excessive groundborne vibration or noise levels?
- → A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?
- → A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

CEQA does not define what noise level increase would be considered substantial. Typically, in high noise environments, if the Ldn due to the project would increase by more than 3 dBA at noise-sensitive receptors, the impact would be considered significant. Where the existing noise level is lower, a somewhat higher increase can be tolerated before significance occurs.

State Building Code

The interior noise environment inside hospital patient rooms is subject to the environmental noise standards set forth in Appendix Chapter 35 sec. 3501 of the California State Building Code (Part 2, Title 24,CCR). The purpose of the regulations as stated therein is to establish uniform minimum noise insulation performance standards to protect persons within new hotels, motels, dormitories, long-term care facilities, apartment houses, and dwellings, other than detached single-family dwellings from the effects of excessive noise, including but not limited to, hearing loss or impairment and interference with speech and sleep.

Multi-family residential structures located in noise-critical areas, such as proximity to highways, county roads, or city streets, shall be designed to prevent the intrusion of exterior noises beyond prescribed levels. The allowable interior noise level attributable to exterior sources shall not exceed 45 dBA in any habitable room. The noise metric shall be either the day/night average noise level (L_{dn}) or the community noise equivalent level (CNEL) consistent with the Noise Element of the local General Plan.

City of Santa Clara

The City of Santa Clara addresses environmental noise issues in the noise section of the General Plan Environmental Quality Element (City of Santa Clara General Plan 1990-2005, adopted July 23, 2002). The City of Santa Clara also regulates noise and vibration through the Santa Clara City Code (Chapter 9.10. Regulation of Noise and Vibration).

General Plan Noise and Land Use Compatibility.

The City uses a noise and land use compatibility chart that establishes areas exposed to an Ldn or CNEL of below 55 dBA to be compatible with residential land uses. Exposure of residences to noise levels between 55 and 70 dBA CNEL or Ldn is judged to require design and sound insulation to reduce noise levels. Noise environments exceeding 70 dBA CNEL or Ldn, are considered incompatible with residential use.

General Plan Noise Policies. The City has adopted policies in the General Plan that address noise that are relevant to this project. These policies are listed below:

Policy 20: Protect to the extent possible existing developed areas of the City of Santa Clara from unacceptable noise levels.

Policy 22: Comply with City, State and Federal guidelines for the compatibility of land uses with their noise environments, except where the City determines that there are prevailing circumstances of a unique or special nature.

Policy 24: Reduce noise from fixed sources, construction and special events.

General Plan Noise Programs. Programs included in the General Plan that address noise and are relevant to this project include the following:

Program (xxvii): Regulate existing noise sources through the City's Noise Ordinance and other applicable codes.

Program (xxviii): Evaluate the impacts of new noise sources on the community and identify appropriate mitigation.

Program (xxix): Adopt, periodically evaluate, and update as appropriate, community noise impact and attenuation standards.

Santa Clara City Code - Regulation of Noise.

The Santa Clara City Code regulates noise and vibration from fixed sources. Exterior noise limits (maximum noise levels) at receiving residential properties are 50 dBA during the nighttime (10:00 PM to 7:00 AM) and 55 dBA during the daytime. The limits at receiving commercial or office properties are 60 dBA during the nighttime and 65 dBA during the daytime. These limits apply to real property and are adjusted upwards in 5 dB increments as appropriate to encompass or reflect louder ambient noise environments.

California Airport Noise Regulations

Section 5006, Title 21, Division 2.5, Chapter 6 of the California Code of Regulations establishes the level of noise acceptable to a 'reasonable' person at a CNEL of 65 dB and identifies the following types of land uses as incompatible with a noise level of 65 dB CNEL or greater:

- Residences of all types;
- Public or private schools;
- Hospitals and convalescent homes

State Aeronautics Act

The State Aeronautics Act (Public Utilities Code Sections 21001 et seq.) covers a range of aeronautical issues governed by the State of California. It references the California Airport Noise Regulations (above) and the California Department of Transportation Airport Land Use Planning Handbook regarding noise issues. The Act also specifically exempts individual emergency aircraft flights from restrictions on time of departure and arrival as described below.

Section 21662.4(a) of the State Aeronautics Act titled "Emergency Flights for Medical Purposes" states that;

> "Emergency aircraft flights for medical purposes by law enforcement, fire fighting, military, or other persons who provide emergency flights for medical purposes are exempt from local ordinances adopted by a city, county, or city and county, whether general law or chartered, that restrict flight departures and arrivals to particular hours of the day or night, that restrict the departure or arrival of aircraft based upon the aircraft's noise level, or that restrict the operation of certain types of aircraft."

Maximum Noise Exposure and Sleep Disturbance

The State of California and the City of Santa Clara typical use a noise descriptor based on average day/night levels (Ldn or CNEL) when judging the compatibility of noise with various land-uses. The Ldn/CNEL metric includes a penalty for noises that occur during the nighttime and evening hours and has proven to be an excellent indicator of potential adverse community response in cases where the dominant noise source is highway or major roadway noise. However, in cases where the noise environment is composed of relatively infrequent high noise level events, such as in the vicinity of an emergency helipad, the Ldn/CNEL descriptor has a tendency to average out the effect that high noise level events can have in terms of sleep disturbance and annoyance. The compatibility of the proposed project has, therefore, been evaluated against supplemental sleep disturbance criteria taken from the conclusions reached by the Federal Interagency Committee on Aviation Noise (FICAN) in the June 1997 paper titled, "Effects of Aviation Noise on Awakenings from Sleep".

In this paper the data and conclusions of the nine field studies were evaluated to predict a 'conservative' dose-response relationship for indoor SEL values and the expected percent of residential awakening using the combined field data of these studies. This dose-response relationship curve, described by $Awakenings = 0.0087\ x\ (SEL\text{-}30)^{1.79}$, is shown in Figure 7 along with the field study results . The FICAN 1997 curve represents the upper limit of the observed field data. Following the FICAN recommendations, this curve should be interpreted as predicting the '*maximum percent of the exposed population expected to be behaviorally awakened*', or the '*maximum % awakened*' for a given residential population.

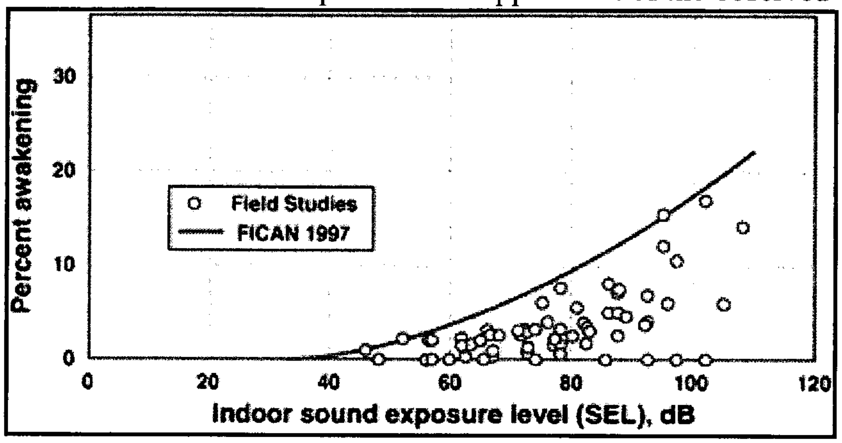

FIGURE 7: FICAN Sleep Disturbance Relationship

Based on the conclusions of the FICAN report and the noise dose-response relationship curve established, it would appear that that an indoor SEL of 80 dB or less would result in 10% or less of a given population being awakened. As noted in the Fundamental Concepts of Environmental Acoustics section at the beginning of this report, typical wood framed residential structures provide exterior to interior noise attenuation of 12 to17 dBA with open windows and around 20 to 25 dBA with closed windows. With the lower range of exterior to interior residential structural attention (i.e. 12 dB with open windows and 20 dB with closed windows) exterior SEL levels of 92 and 100 dB would produce a respective interior SEL levels of 78 dB with open and closed windows. Using these exterior levels, the 92 dB exterior SEL contour appears to be a good predictor of areas exposed to a heightened degree of potential sleep disturbance during helicopter operations in the worst-case condition with windows open.

EXISTING NOISE ENVIRONMENT WITHOUT THE PROPOSED HELIPAD

Thorburn Associates (TA) conducted noise measurements at the southern lot line in July 2001. At that time, the existing ambient noise levels along the lot line were between 52-64 dBA L_{dn} along the lot line. TA's calculations show that the new hospital complex, without the proposed helipad, will generate noise levels of between 49 to 54 dBA L_{dn} at the southern lot line. The resulting cumulative levels from, non-helipad, hospital complex activities and the existing background noise will be between 56 and 64 dBA L_{dn}.

HELIPAD OPERATIONAL NOISE

Helicopter Noise Character

Helicopter noise has it's own distinct character. Although a portion of the noise emanates from the engines themselves, the distinctness of helicopter noise is largely due to the modulation of sound created by the relatively slow turning main rotor. This sound modulation is referred to as blade slap. Blade slap is most pronounced during low speed descents and high-speed cruise. To the ground observer helicopters are most audible as the aircraft approaches a landing area. Figure 2 shows 65 and 75 dBA maximum instantaneous noise level ground contours for a typical small helicopter on takeoff and landing.

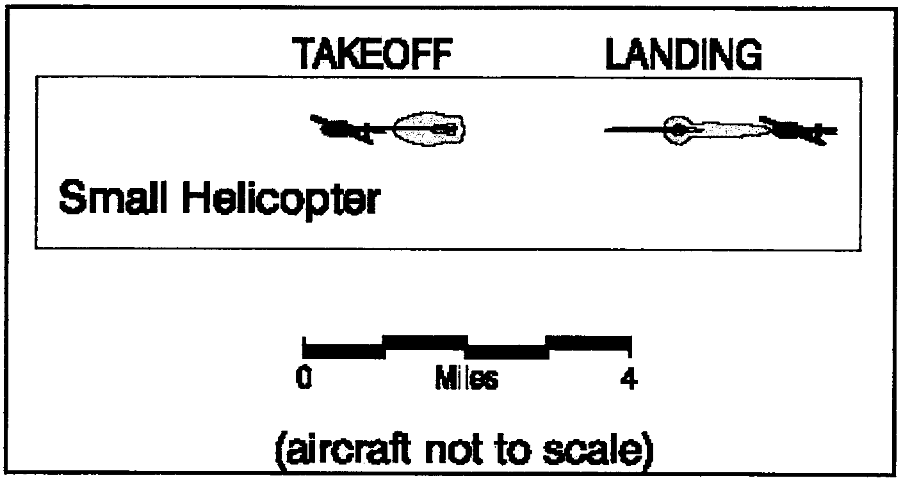

FIGURE 2: Typical Helicopter Noise footprint

PROPOSED LAWRENCE EXPRESSWAY/HOMESTEAD ROAD FACILITY

Helipad Location, Flight Paths, and Operations

The Helipad at the new Kaiser Santa Clara Hospital facility will be located on a raised platform 17-feet above the parking surface. The helipad is located 1070 feet from the north lot line, 760 feet from the west lot line, 310 feet from the south lot line, and 1270 feet from the east lot line. The helipad would be approximately 65 feet from the hospital's southern façade. The primary flight paths into and out of the helipad are projected to follow east to west ground tracks. Incoming flights will generally approach from the east and departing flight will generally leave the pad heading west. The location of the helipad and primary approach and departure flight ground tracks, relative to the site are shown in Figure 3.

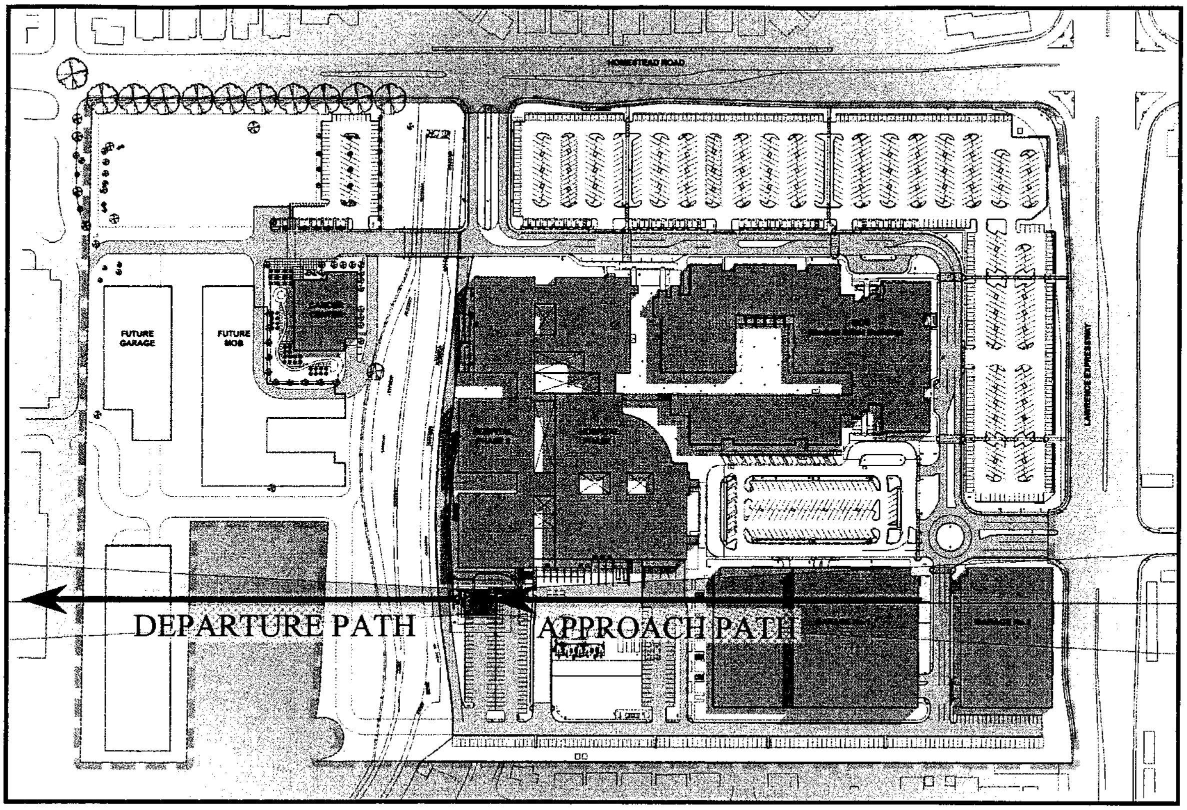

Figure 3: Site Plan and primary approach and departure ground tracks

The expected operational noise levels produced by helicopters approaching and departing the proposed helipad can be divided into distinct activities, which are discussed below;

Departures: For a helicopter departure the craft first performs it's startup and flight checks in a ground idle phase. This typically lasts about 3 minutes. Given the relationship between the proposed helipad and the closest residential land uses (approximately 310 feet south of the helipad and approach & departure flight paths), this activity is expected to produce a maximum noise level of 69 to 74 dBA at the closest residential property line. Following the flight checks and start-up, the rotor blades begin turning at full power, a hover is initiated and the craft ascends vertically to 100 feet above the pad. This phase typically takes about 10 seconds and is expected to produce a maximum noise level of 84 dBA at the closest residential property line. Once an altitude of 100 feet is achieved, the helicopter accelerates horizontally for 200 feet and reaches an air speed of 70 knots. This activity will take less than 5 seconds and is expected to produce a maximum noise level of 80 dBA at the closest residential property line. After accelerating to 70 knots the craft begins to ascend to an altitude of 1000 feet, which it achieves after covering just under one-half mile horizontally. This activity will take less than 30 seconds and can produce maximum noise levels of 80 to 72 dBA along an extension of the southern property line and on the ground plane directly beneath the flight path. At an elevation of 1000 feet the helicopter accelerates to it's cruising speed of 125 knots in level flight, producing maximum noise levels of between 70 to 71 dBA on the ground directly beneath its flight path. Overall the main noise producing portion of the departure to altitude and cruising speed from initial start up will take under 4 minutes, with surrounding land uses exposed to maximum sound levels over 80 dBA less than one minute of this time.

Approaches: A helicopter approach to the pad begins with the craft traveling at 125 knots at a cruise elevation of 1000 feet, producing maximum noise levels of between 70 to 71 dBA on the ground directly beneath its flight path. Between 1 mile and ½ mile from the helipad the craft decelerates from 125 knots to 70 knots, producing ground level maximum noise of between 73 and 74 dBA. At about ½ mile from the helipad, the craft begins to descend to a height of 100 feet at a distance of 200 feet from the 'pad and decelerate to 70 knots. This activity will take less than 30 seconds and can produce maximum noise levels of 75 to 83 dBA along an extension of the southern property line and on the ground plane directly beneath the flight path. During the final 200 foot approach to the helipad the helicopter descends an additional 20 feet to a height of 80 feet above the 'pad and decelerates to a ground speed of zero. This activity will take less than 5 seconds and is expected to produce a maximum noise level of 84 dBA at the closest residential property line. Once a ground speed of zero is reached the helicopter begins a vertical descent to the landing pad. This phase typically takes about 10 seconds and is expected to produce a maximum noise level of 84 dBA at the closest residential property line. Once on the helipad surface the craft unloads its cargo while undergoing a 2-minute ground idle. As with the departure idle, this activity is expected to produce a maximum noise level of between 69 and 74 dBA at the closest residential property line. Following the idle period, the craft is either shut down to await another cargo or initiates its departure procedures. Overall the main noise producing portion of the helicopter approach will take under 3 minutes, with surrounding land uses exposed to maximum sound levels over 80 dBA less than two minutes of this time.

Average Noise Exposure

The helipad may be used by any of several Emergency Medical Services (EMS) companies. The helicopters typically used by these companies include the Bell 222, Augusta 109, MBB B105, and Eurocopter models BK-117, AS355, and AS365.

To determine the expected noise levels produced by helicopter operations on the site and in its vicinity, Thorburn Associates (TA) utilized the Federal Aviation Administration's (FAA) Helicopter Noise Model (HNM) version 2.2 to establish noise contours for helipad operations. The Kaiser Santa Clara facility is not a "trauma center", and therefore the helipad is for emergency use only. The anticipated usage is 1-2 helicopter events per month.

The HNM 2.2 model contains complete noise data for the Bell 222 and the Augusta 109, which represent one of the highest capacity EMS helicopters and a middle capacity, respectively. The Augusta 109 noise levels are slightly greater than though produced by the Bell 222. To conduct a conservative or "worst case" analysis of helipad operations, TA conducted the model for a day in which one (1) Augusta 109 helicopter approached and departed the helipad[1]. Helicopter flight profiles were established (by TA) through the adaptation of local EMS take-off and approach data to the site conditions (see Figures 4 and 5).

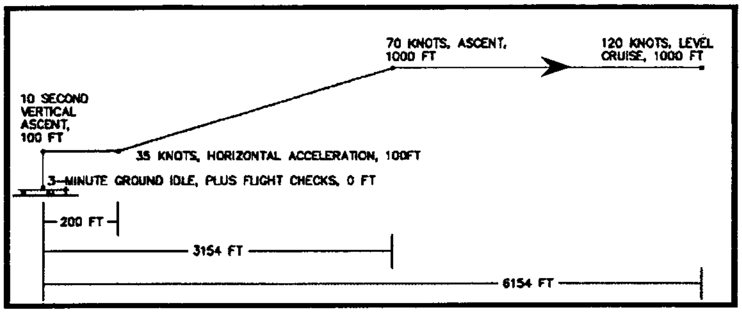

Figure 4: Typical Departure Profile

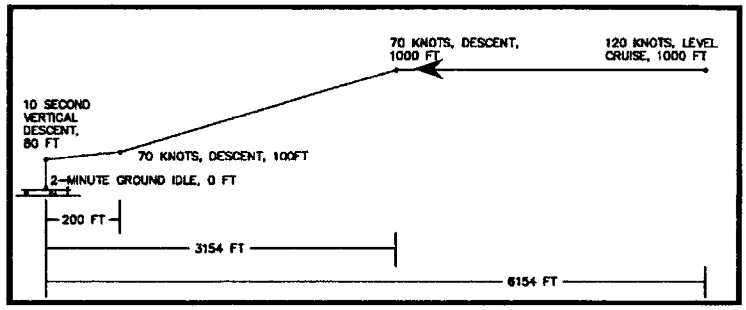

Figure 5: Typical Approach Profile

Incoming flights were modeled as approaching from the east and departing flights were modeled heading west from the facility. TA reports that these approach and departure direction are a reasonable simulation of how the Helipad will be used. The 45, 50, 55, 60 and 65 dBA Ldn noise contour output of TA's HNM model is shown in Figure 6.

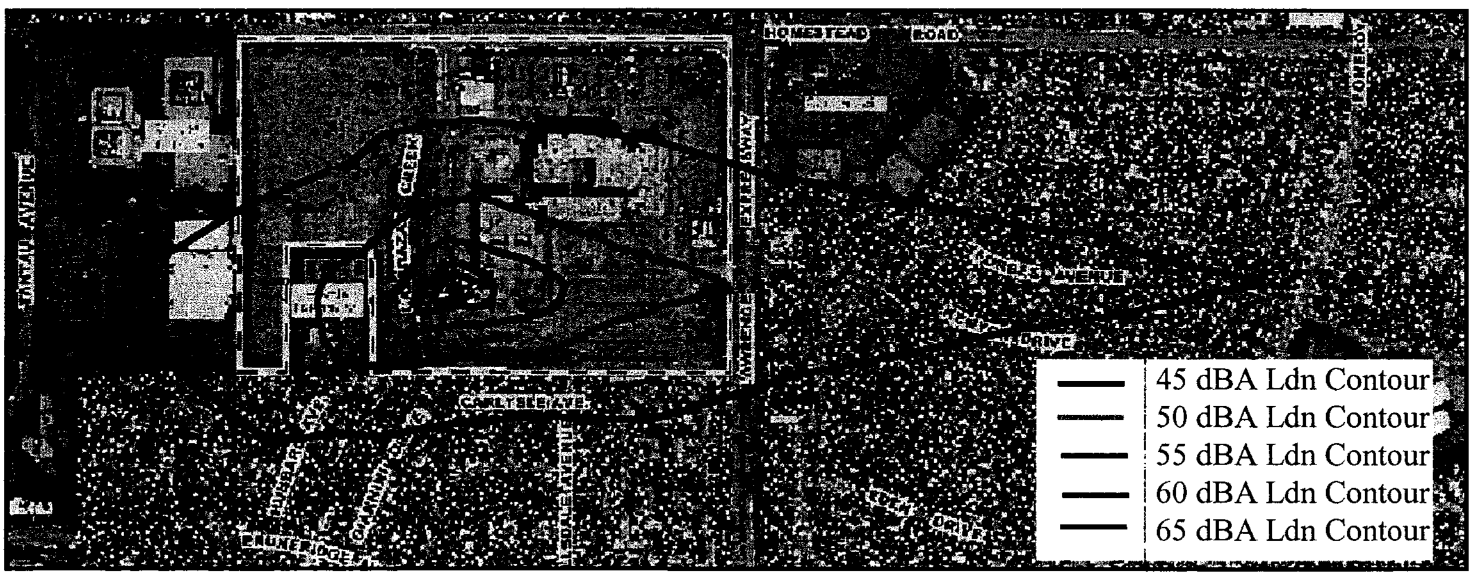

FIGURE 6: SITE AERIAL WITH Ldn HELIPAD NOISE CONTOURS

[1] Note that FAA approved aircraft noise models are typically run for the annual average daily usage, which in this case would establish the "average" usage at 2 helicopters per 30 days or an average of .066 flights per day.

Maximum Noise Exposure

To determine the worst-case noise exposure at residential uses under the proposed approach and departure paths, the SEL during a single combined takeoff and landing of an A109 helicopter was derived from the HNM model results[2]. The extent of the 92 dBA SEL contour is shown in Figure 8, below.

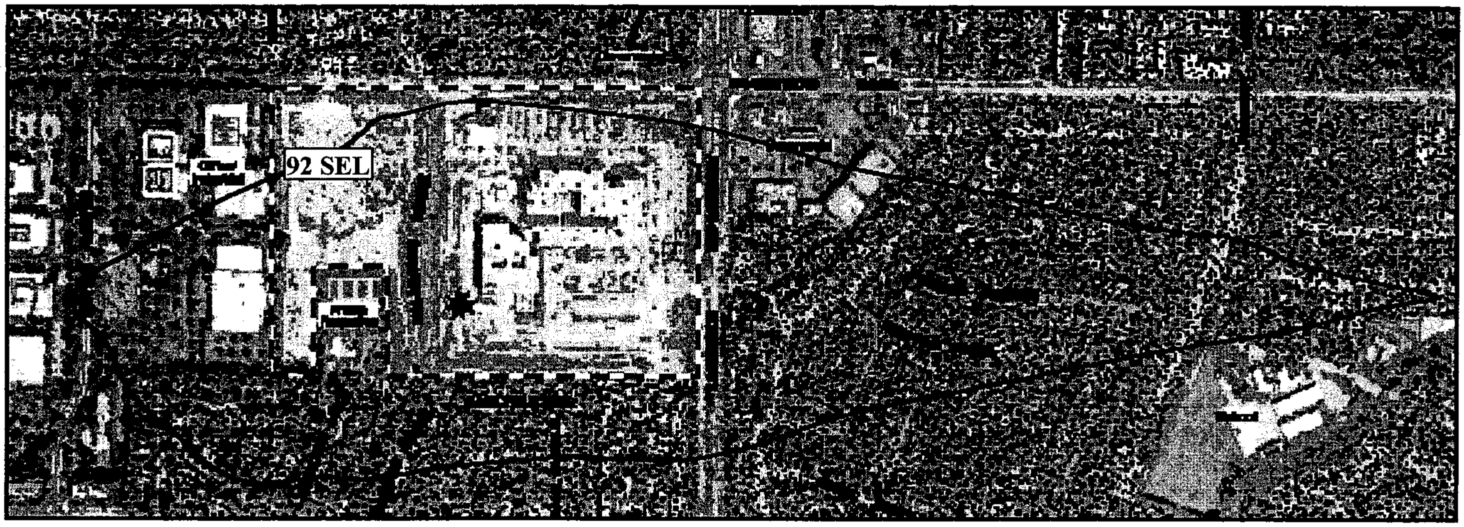

FIGURE 8: SITE AERIAL WITH 92 dBA SEL HELIPAD NOISE CONTOUR

Noise Exposure at Specific Residential and Hospital Facade locations

To quantify the specific average noise level (Leq) and Sound Exposure Level (SEL) due to a single helicopter approach and departure at residential lot lines to the south of the project site and at the southern facades of the hospital TA model the helicopter event Leq and SEL levels, along with resulting hourly Leq and Ldn due the expected helipad operations at thirteen (13) locations (1 through 13) on the southern lot line and ten (10) locations (14 through 23) on the southern facade of the Hospital. The modeling locations are shown in Figure 9, with the modeling results shown in Table 3.

Based on the results shown in Table 3, the residential lot lines directly to the south of the hospital will be exposed to average sound levels of 64 to 72 dBA and SELs of 92 to 99 dBA during a typical helicopter approach/departure event. Though they will be exposed to relatively high event related noise levels, due to the infrequent use of the helipad on an average day/night level basis, the residential lot lines will be exposed to an Ldn of 40 to 50 dBA. These results also show that the hospital's southern facade will be exposed to average sound levels of 75 to 84 dBA and SELs of 103 to 112 dBA during a helicopter approach/departure. On an average day/night level basis, the hospital's southern facade will be exposed to an Ldn of 50 to 63 dBA.

[2] The relationship between the **SEL** and the **Ldn** a single daytime arrival and departure can be expressed as follows: **Ldn** = **SEL** +10log(**N**) – 10log (**T**), were **N** equals the number of events and **T** equals the number of seconds per day. Based on **N** = 1 and **T** = 86400 sec. The 92 dBA SEL contour equals the 42.6 dBA Ldn contour.

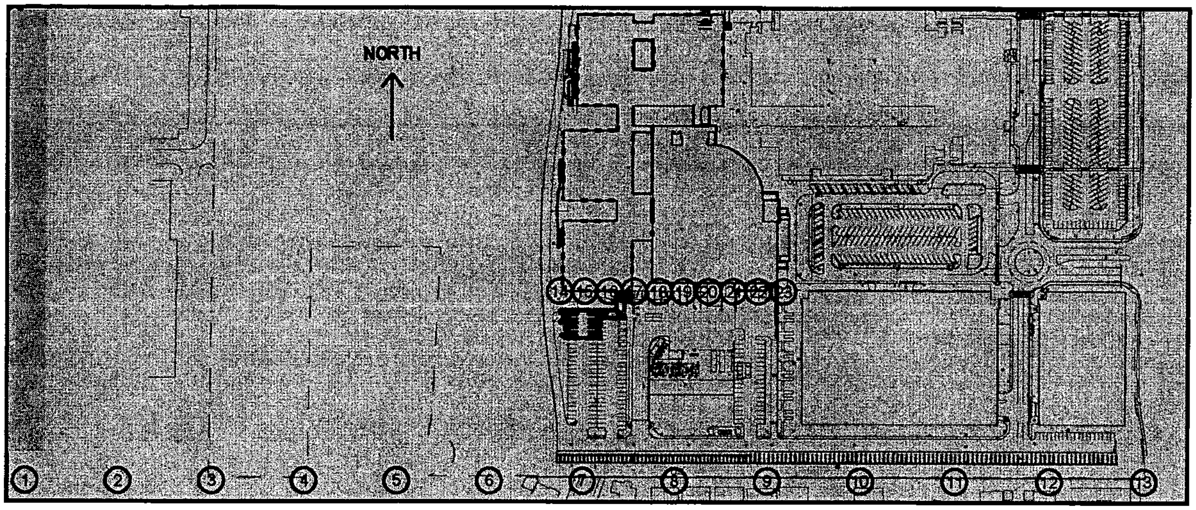

FIGURE 9: RESIDENTIAL AND HOSPITAL FACADE MODELING LOCATIONS

TABLE 3: NOISE EXPOSURE AT LOT LINE AND HOSPITAL FACADE LOCATIONS

Noise Receptors		Noise Levels, dBA			
Location #	Type	Event Leq	Event SEL	Hourly Leq	Ldn
1	Res. Lot Line	64	92	57	43
2	Res. Lot Line	65	93	58	44
3	Res. Lot Line	67	94	59	45
4	Res. Lot Line	68	96	60	47
5	Res. Lot Line	70	98	63	49
6	Res. Lot Line	72	99	64	50
7	Res. Lot Line	70	98	63	49
8	Res. Lot Line	70	98	62	49
9	Res. Lot Line	70	97	62	48
10	Res. Lot Line	69	96	61	47
11	Res. Lot Line	68	96	60	46
12	Res. Lot Line	67	95	59	45
13	Res. Lot Line	66	94	58	45
14	Hosp. Facade	81	109	73	59
15	Hosp. Facade	84	112	76	63
16	Hosp. Facade	83	111	75	61
17	Hosp. Facade	80	108	73	59
18	Hosp. Facade	79	107	71	57
19	Hosp. Facade	78	105	70	56
20	Hosp. Facade	77	104	69	55
21	Hosp. Facade	76	104	68	55
22	Hosp. Facade	76	103	68	54
23	Hosp. Facade	75	103	67	53

EXISTING KIELY BOULEVARD FACILITY

Helipad Location and Flight Paths

The existing Kaiser Hospital facility does not have a dedicated helipad, instead helicopters land on Kaiser Drive adjacent to the hospital's emergency entrance. To accomplish this local public safety officers (fire or police) close down Kiely Boulevard either side of the landing spot to keep vehicle traffic from interfering with helicopter operations. Depending on wind conditions helicopters approaching or departing the landing area use the following flight paths (Fig. 10)[3]:

Approaches

Normal Wind Conditions (winds out of the northwest)

1. Travel eastbound south of Benton Street at approximately 1,000 feet above ground
2. Turn right (southbound) and overfly Central Park, descending to approximately 300 feet above ground
3. Turn westbound along Kaiser Drive, crossing Kiely Boulevard at about 300 feet, above trees on the eastern side of Kiely.
4. Descend steeply to a landing on Kaiser Drive, opposite the emergency entrance.

Abnormal wind conditions (winds out of the southeast)

1. Travel westbound along Homestead Road at approximately 1,000 feet above ground
2. Turn right (northbound) approximately over Pepper Tree Lane while overflying residential areas west of the hospital and descending to approximately 300 feet above ground
3. Turn right (eastbound) at approximately 300 feet above ground.
4. Descend steeply to a landing on Kaiser Drive opposite the Emergency Entrance.

Departures

Normal Wind Conditions (winds out of the north)

Departures are normally performed by lifting to an approximate 100-foot high (above ground) hover and then climbing straight out toward the west, with no local turns to an approximately 1,000-foot enroute altitude. Helicopter climb performance depends upon a number of factors including how heavily it is loaded, local temperature and humidity conditions, piloting techniques, etc. The worst-case altitude when crossing Pepper Tree Lane would be about 250 feet although in most cases, it is higher.

Abnormal wind conditions (winds out of the south)

If winds are strong enough to require an eastbound departure, the liftoff and hover up to 100 feet would occur facing eastbound. The helicopter would then climb to approximately 250 feet before reaching Central Park and then turn right (southbound) over Central Park while continuing to climb. It would then turn right again (westbound) at approximately Homestead Road while climbing to an enroute altitude of approximately 1,000 feet above the ground. There would be no further local turns.

[3] Jeff Wright - Heliplanners via email July 25, 2005

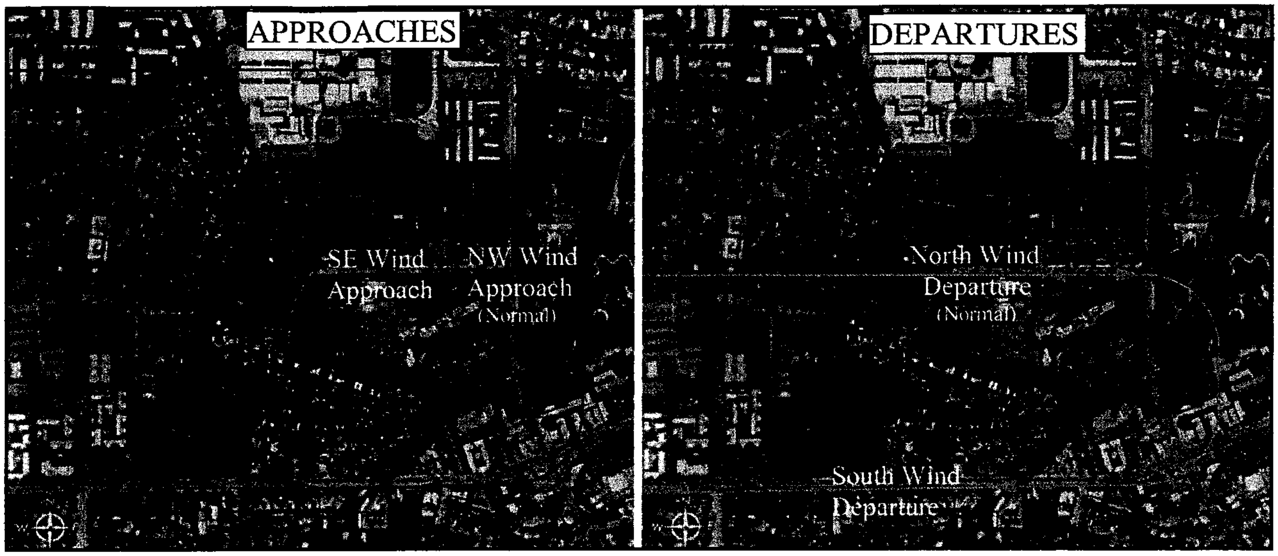

FIGURE 10:EXISTING FACILITY FLIGHT PATHS

Average Noise Exposure

To determine the expected noise levels produced by helicopter operations at the existing Kaiser Hospital on Kiely Boulevard, Illingworth & Rodkin, Inc. (I&R) utilized the Federal Aviation Administration's (FAA) Helicopter Noise Model (HNM) version 2.2 to establish noise contours for helipad operations using the same methodology as TA used to model the proposed facility. Typically 9 flights per year utilize the Kiely Boulevard facility. To conduct a conservative or "worst case" analysis of helipad operations, I&R conducted the model for a day in which one (1) Augusta 109 helicopter approached and departed the helipad[4]. Helicopter flight profiles were established through the adaptation of approach and departure information for the site (see above).

Maximum Noise Exposure

To determine the worst-case noise exposure for normal and abnormal wind conditions, the SEL during a single combined takeoff and landing of an A109 helicopter was derived from the HNM model results[5], which were based on a single takeoff and landing of an A109 helicopter. The extent of the 92 dBA SEL contours for normal and abnormal wind conditions are shown in Figure 13.

[4] Note that FAA approved aircraft noise models are typically run for the annual average daily usage, which in this case would establish the "average" usage at 9 helicopters per year or an average of .0025 flights per day.

[5] The relationship between the **SEL** and the **Ldn** a single daytime arrival and departure can be expressed as follows: **Ldn** = **SEL** +10log(N) – 10log (**T**), were **N** equals the number of events and **T** equals the number of seconds per day. Based on **N** = 1 and **T** = 86400 sec. The 92 dBA SEL contour equals the 42.6 dBA Ldn contour.

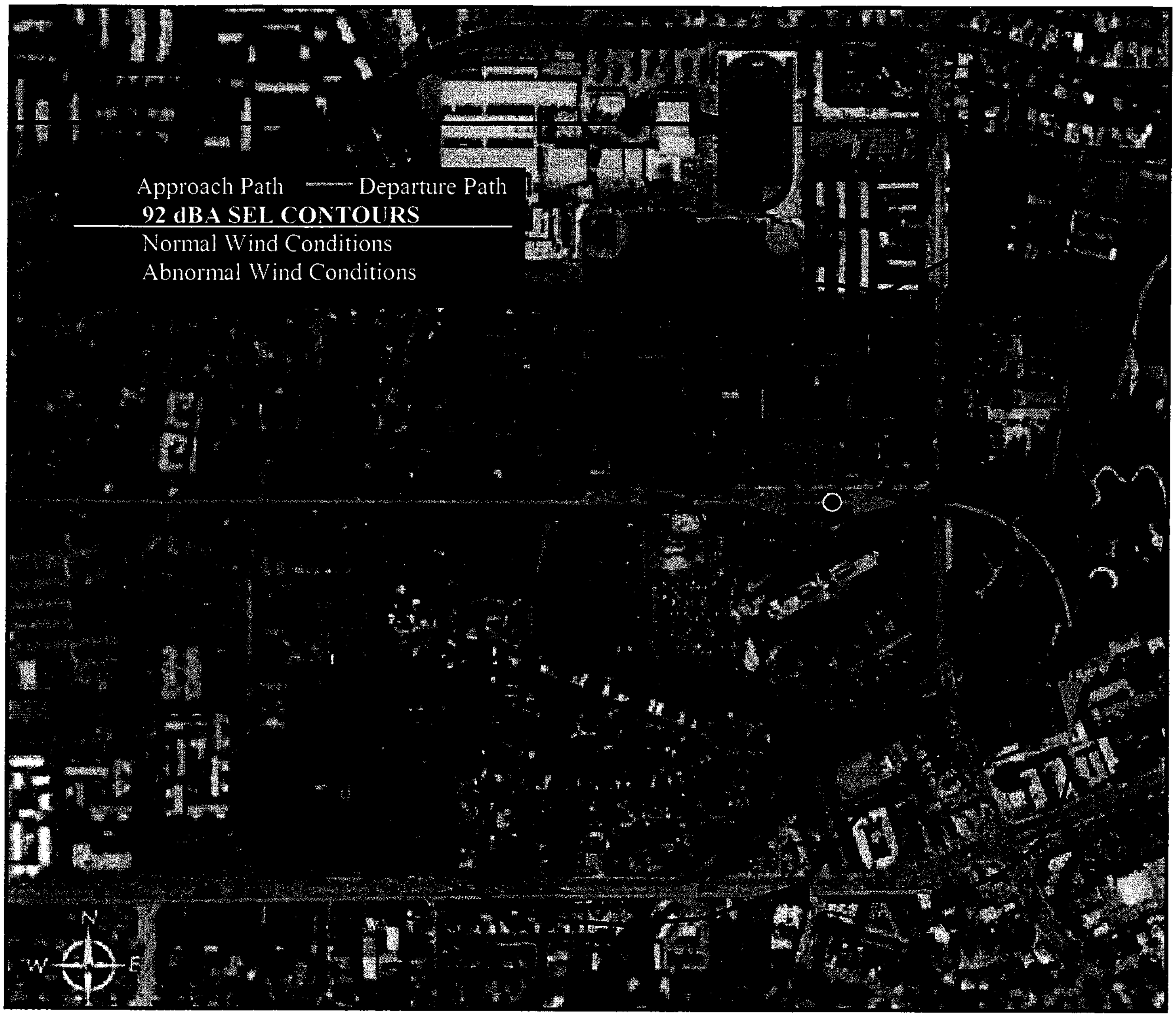

FIGURE 13: 92 dBA SEL Contours for Normal and Abnormal Wind Conditions

COMPARISON OF AREAS UNDER FUTURE VS. EXISTING NOISE CONTOURS

The relative appearance of the future and existing SEL curves for the future (Kaiser Lawrence Expressway Facility) versus existing (Kaiser Kiely Blvd. Facility) conditions are different. This difference occurs due to two factors; the first being that helicopter approaches to the existing helipad require a steeper approach and departure slope due to ground level obstructions such as large trees and buildings which must be avoided that do not occur at the new facility, and the second being the non-linear (i.e. curved) approach paths at the Kiely Blvd. site which effectively concentrates the area exposed to high noise levels whereas the linear (i.e. straight) approach path at the Homestead Road facility effectively spreads out the area exposed to short-term high noise levels.

A visual analysis of aerial photographs shows a large multiple family (condominium) development and the existing hospital and medical office buildings within the existing 92 dBA SEL contour under normal wind conditions. When the alternative approach and departure are used at the Kiely Boulevard site, additional single family and multiple family residences to the west and south are within the 92 dBA SEL. For the proposed helipad site, the 92 dBA SEL extends over single family and multiple family residences and commercial uses to the east of Lawrence Expressway and single family and multiple family residences to the south of the new Kaiser Medical Center site.

PROJECT IMPACT AND MITIGATION MEASURES

Significance Criteria

1. A significant impact would be identified for existing uses on the project site or land uses adjacent to the project if they would be exposed to noise levels exceeding either the City's established guidelines for "satisfactory" noise and land use compatibility or the CNEL in the Santa Clara General Plan.
2. According to CEQA, a significant noise impact would result if noise levels increase substantially at noise-sensitive land uses (e.g., residences). A substantial increase to noise levels would occur if the project resulted in an increase of 3 dBA or greater at noise-sensitive land uses where noise levels already exceed 60 dBA Ldn.
3. A significant local impact can be identified for existing uses near the project if they would be exposed to a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. A substantial periodic increase is judged to occur if the project resulted in sleep disturbance or annoyance rates of greater than 10% of the people in residences in the project vicinity. Based on the findings/conclusions of the FICAN paper previously discussed, this would equate to areas within the 92 dB exterior SEL contour produced during helicopter approaches and departures from the proposed helipad under worst-case conditions. Within the urban area of the City of Santa Clara a significant impact would result if residents are exposed to more than 10 nighttime overflights per year that could result in sleep disturbance.

Impact 1: Helipad operational noise impacts on the project site

Based on the results of the HNM noise model, the operation of the proposed helipad would not expose any non-helipad related uses to an Ldn of 65 dBA or more. Therefore, noise impacts based on average noise exposure to the proposed facility would not be expected to occur.

Based on the exterior wall and window design of the Hospital, the walls and windows would provide respective attenuations of 40 and 33 dBA SEL at "helicopter frequencies" for an overall exterior to interior attenuation of 35-36 dBA SEL. Based on this degree of attenuation and considering both landing and take-off operations, the rooms closest to the helipad would have interior noise levels of 75 dBA SEL, with levels of 65 dBA further along the facade.[6] Therefore, noise impacts based on maximum noise levels during helicopter operations within the interiors of the proposed facility would not be expected to occur.

Mitigation 1: None Required

Noise impacts resulting from average and maximum noise exposure levels due to helipad usage on the project site are considered to be less-than-significant and no mitigation is required.

Impact 2: Helipad operational noise impacts on the adjacent land uses due to average noise exposure levels.

The operation of the proposed emergency helipad under the proposed or "worst case" operational levels will not expose any non-project site land uses or residential structures to an Ldn/CNEL of 65 dBA or greater[7]. This is not considered to be a significant noise impact.

Mitigation 2: None Required

Noise impacts resulting from average noise exposure levels due to helipad operations on non-project land uses are considered to be less-than-significant and no mitigation is required.

Impact 3: Helipad operational noise impacts on the adjacent land uses resulting from annoyance and sleep disturbance.

Residential uses under the helicopter approach and departure paths and to the south of the project site will be exposed to relatively infrequent high noise level events that could cause periodic sleep disturbance of some residents. The noise levels produced by helicopter flights to the hospital could be annoying to some residents. Emergency evacuations of patients are anticipated to be relatively infrequent. Evacuations of premature infants by helicopter to Stanford Medical Center have averaged approximately three (3) to four (4) times per year (source Lee Ann Knight, Senior Project Manager, Kaiser Permanente). For the purposes of this analysis, a worst-case of an average of fifteen (15) flights per year over two years is being considered. Assuming that helicopter evacuations would occur at random times during the day, sleep disturbance of residents under the planned flight path during nighttime hours (10 PM to 7 AM) could range from approximately one (1) to four (4) times per year in the near term and as many as six (6) to fifteen (15) times per year in the future. Assuming a worst-case condition, helipad operations under the proposed project would result in a significant periodic noise impact.

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[6] Building Shell attenuation and interior SEL levels as communicated by Tyler Rynberg of Thorburn Associates via telephone on July 6, 2005, and reported via email on July 7, 2005.

[7] The analysis of helipad operations for the new facility discussed above assumed a "worst case" situation in that one (1) Augusta 109 helicopter approached and departed the helipad per day, whereas FAA approved aircraft noise models are typically report the annual average daily usage, which in the case of the new Kaiser helipad operation would establish the "average" usage at 2 helicopters per 30 days or an average annual number of flights of .066 per day (which is significantly less than 1 per day).

Mitigation 3:

The following measures could reduce annoyance from helicopter overflights by minimizing high noise level exposures during approach and departure; (a) modify the approach profile to maintain a greater elevation over the residential uses east of the Lawrence Expressway or (b) maintaining a log of flight operations and on-going communications with helicopter pilots regarding approach and departure paths. These mitigation measures are discussed below.

a. *Approach profile modification.* Based on a review of TA's 92 dBA SEL contour versus the approach used in their analysis and the relatively steep approach angle used at the existing Kiely Blvd. facility, it appears that if approaching helicopters maintain a high elevation until the helicopters pass over the Lawrence Expressway and use a steep approach angle between the Lawrence Expressway and the helipad, the SEL of approaching helicopters at the residential land uses east of the Lawrence Expressway would be reduced.

b. *Designating a Noise Disturbance Coordinator and Monitoring Helicopter Arrivals and Departures.* A program of monitoring helicopter operations and designating a community noise disturbance coordinator could be used to reduce noise annoyance in nearby residential areas. As a part of these measures, helicopter ambulance companies and pilots would be informed of designated flight paths and approach profiles to and from the hospital helipad to avoid or reduce short-term noise exposures to residential areas. A helipad log could be maintained that includes arrival and departure times, the approach route taken, and explanation of any flight path deviation from the designated flight paths. A noise disturbance coordinator would be identified who would record citizen complaints and review the helipad log to determine the source of the noise disturbance.

   The noise disturbance coordinator, or other Kaiser Permanente staff, could also notify emergency communications dispatchers in the City of Santa Clara of incoming emergency helicopter flights. The purpose of timely notification by Kaiser Permanente would be to facilitate responses to inquiries by citizens and other agencies as to the nature and purpose of helicopter overflights in the area.

Conclusion/Additional Discussion: Under worst-case conditions, the project would result in significant noise annoyance from new emergency helicopter operations. Establishing a program of monitoring helicopter operations and responding to community noise disturbance complaints could reduce potential annoyance by avoiding flight elevations and paths that are most annoying to residents, to the extent feasible for individual emergency flights and by providing information on the nature and purpose of emergency flights. Since the timing and frequency of helicopter operations is a function of when non-scheduled (emergency) evacuations are required, and under the worst-case scenario more than 10 nighttime flights per year could occur, the effects of the project would be considered significant and unavoidable.